REMARKS

Claims 28-31 are pending in the present application. Claims 1-27 have been cancelled. New claims 28-31 has been added. No new matter has been added.

In the Examiner's Final Office Action of 12/28/2006, the Examiner requested that Applicant clarify the term decorrelation function as used in the claims, to point out where in the specification the decorrelation function is described, and to clarify why the claims are patentable over the prior art cited. The Applicant thanks the Examiner for his thorough examination of the application.

Applicant respectfully submits that new claims 28-31 are patentable as written. Further, Applicant respectfully submits that each claim addresses the Examiner's requests which pertained to newly cancelled claims 1-27.

Initially, Applicant submits that independent claim 28 is patentable because it distinctly sets forth the matter claimed. Particularly, in response to the Examiner's request, independent claim 28 defines the variables used in the equations referenced.

In addition, Applicant submits that the calculating step of independent claim 28 is sufficiently disclosed in the specification. Specifically, the calculation is described on pages 11-17 and 20-23 of the specification. Applicant submits that the steps for basic position determination using real time kinematics including Kalman filters are known by those skilled in the art. Therefore, there does not need to be a detailed description of these processes in the specification.

Additionally, Applicant submits that independent claim 28 is patentable because it discloses subject matter not described by any of the prior art references cited by the Examiner. Specifically, none of the cited prior art references disclose the explicit inclusion of distance dependent and distance independent errors into a Kalman filter.

Teunissen fails to teach selecting a model α of distance dependent and distance independent errors in the first and second measurements and, based on the model α, calculating a double differenced variance matrix: $D(L_1, L_2) = \begin{vmatrix} D_{11} & 0 \\ 0 & \overline{D}_{22} \end{vmatrix}$, wherein

$$D_{11} = 2R_{L2}^2 \begin{vmatrix} W_1 + W_{ref} & W_{ref} & \cdots & W_{ref} & W_{ref} \\ W_{ref} & W_2 + W_{ref} & \cdots & W_{ref} & W_{ref} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ W_{ref} & W_{ref} & \cdots & W_{n-2} + W_{ref} & W_{ref} \\ W_{ref} & W_{ref} & \cdots & W_{ref} & W_{n-1} + W_{ref} \end{vmatrix} \text{ and wherein,}$$

$$\overline{D}_{22} = (R_{L2}^2 + \alpha^2 R_{L1}^2 - 2\alpha R_{L1,L2}) \begin{vmatrix} W_1 + W_{ref} & W_{ref} & \cdots & W_{ref} & W_{ref} \\ W_{ref} & W_2 + W_{ref} & \cdots & W_{ref} & W_{ref} \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ W_{ref} & W_{ref} & \cdots & W_{n-2} + W_{ref} & W_{ref} \\ W_{ref} & W_{ref} & \cdots & W_{ref} & W_{n-1} + W_{ref} \end{vmatrix}.$$

Wherein

$$R_{L1} = (\frac{1}{\lambda_1^2}[R_{non-dist,L1}^2 + (R_{ion}^2 + R_{trop}^2 + R_{orb}^2) \cdot B^2])^{\frac{1}{2}},$$

$$R_{L2} = (\frac{1}{\lambda_2^2}[R_{non-dist,L2}^2 + (R_{ion}^2 + R_{trop}^2 + R_{orb}^2) \cdot B^2])^{\frac{1}{2}}, \text{ and}$$

$$R_{L1,L2} = \frac{1}{\lambda_1 \lambda_2}(R_{ion}^2 + R_{trop}^2 + R_{orb}^2) \cdot (\frac{f_1^4}{f_2^4} R_{ion}^2 + R_{trop}^2 + R_{orb}^2) \cdot B^2.$$

Instead, Teunissen teaches that errors should be ignored which represent "carrier phase measurement noise and biases such as satellite ephemeris errors, tropospheric and ionospheric delays, and ranging errors caused by multipath." (Teunissen, pg. 563.) Specifically, Teunissen states: "In the following we will assume that the bias-terms in e are either corrected for or sufficiently small to be neglected." (Teunissen, pg. 564.) As stated in claim 28, these errors are part of the claimed updating of the Kalman filter.

Similarly, Rapoport fails to teach the above-referenced limitation of independent claim 28. Instead, Rapoport teaches a short-baseline GPS application and teaches that atmospheric errors may be ignored over the short baseline. Rapoport explains ignoring these errors:

> However, the atmospheric effect can be substantially eliminated in a differential GPS mode where the phase of the satellite is measured at a rover station and a base station, $\phi^S_{A,R}(t)$ and $\phi^S_{A,B}(t)$ respectively, and then subtracted from one another. Over the short baseline between the rover and base stations, the atmospheric delay $\tau_{ATM}(t)$ in both of these phases is equal for practical purposes....

(Rapoport, Col. 9, l. 62 - Col. 10, l. 2.) Rapoport uses this approximation in order to cancel $\tau_{ATM}(t)$, which is "delay due to anomalous atmospheric effects which occur mostly in the upper atmosphere," from the combination of equations of the phases of signals received at a rover and a base station. (Rapoport, Col. 9, ll. 44-61.) As stated in claim 28, these errors are part of the claimed updating of the Kalman filter.

Dai fails to teach the above-referenced limitation of independent claim 28. Instead, Dai teaches an application for ambiguity resolution based on outlier detection. When referencing ionospheric delay, Dai teaches comparing ionospheric delay from a neighboring epoch in order to detect outliers. Dai explains:

> As is well known, the Total Electron Content (TEC) of the path through the ionosphere has very strong correlation in space and time. The TEC value for the neighboring epoch should therefore be very close and this information will be considered as the basis for a global test. The difference between the double-differenced ionospheric delay on L1 and L2 carrier phase observations is defined as Δ_{ion}. If the integer ambiguities are resolved correctly, the Δ_{ion} sequence should change smoothly. Otherwise, a jump will occur due to wrong ambiguity resolution. The criterion $\delta\Delta_{ion} < 5.0cm$ is used for fault detection in this paper. If the $\delta\Delta_{ion} > 5.0cm$, the ambiguity sets are considered to have been fix [sic] to the wrong values. Hence, the corresponding ambiguities should be rejected.

(Dai, pg. 324.) Thus, Dai teaches using measured ionospheric delay to reject outliers in order to aid in resolving ambiguities.

As stated in claim 28, the ionospheric delay and other errors are part of the claimed updating of the Kalman filter. Dai fails to teach this use of the ionospheric delay or other errors. Rather, Dai teaches using ionospheric delay as an input to a binary determination ($\delta\Delta_{ion} < 5.0cm$ or $\delta\Delta_{ion} > 5.0cm$) for rejecting outliers to aid ambiguity resolution.

Park fails to teach the above-referenced limitation of independent claim 28. Instead, Park teaches a short baseline (4m baseline) application in order to "minimize the effect of multipath." (Park, pg. 282.) Park explains:

> Since assumed noise characteristics does [sic] not hold as a baseline length increases, true ambiguities may be rejected by the epoch by epoch approach. The multi-epoch approach suffers from the curse of a search volume because for a short time period the condition number of matrix Ξ is too wild to give reliable result. Thus the epoch by epoch approach will be preferred to short baseline applications such as an attitude determination while the multi-epoch approach will be preferred to long baseline applications such as surveying.

(Park, pg. 281.)

The only experimental result described in Park is for a short baseline experiment where the baseline was measured by a ruler. (Park, pg. 282.) No multi-epoch results are discussed by Park. Importantly, Park does not describe the use of errors which Park neglects while using short baseline. (Park, pg. 281.) As stated in claim 28, these errors are part of the claimed updating of the Kalman filter.

Thus, each of Teunissen, Rapoport, Dai or Park fails to teach the above-referenced limitation of independent claim 28. Applicant submits that independent claim 28 is therefore patentable over each of those references.

Further, Applicant submits that independent claim 30 is patentable for the same reasons that independent claim 28 is patentable. In addition, Applicant submits that dependent claims 29 and 31 are also patentable, as they depend from patentable claims.

CONCLUSION

It is respectfully submitted that all of the Examiner's objections have been successfully responded to via amendment of the claims and/or via traverse. It is further respectfully submitted that the application is now in order for allowance. Accordingly, reconsideration of the application and allowance thereof is courteously requested.

Respectfully submitted,

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